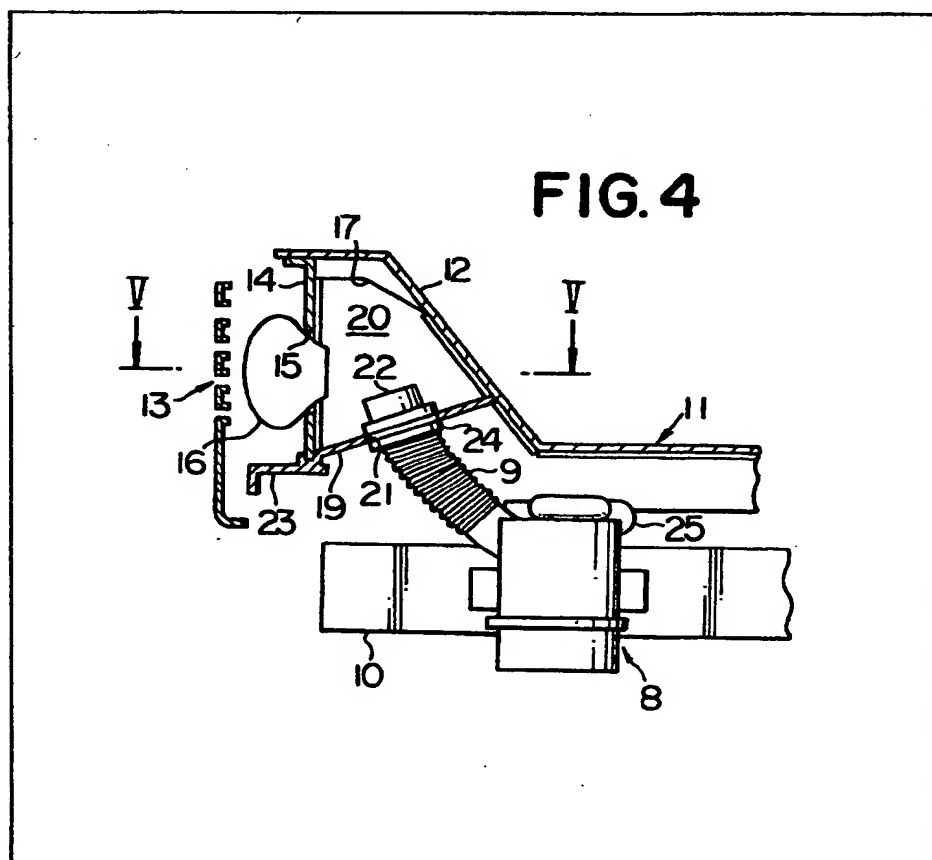


# (12) UK Patent Application (19) GB (11) 2 110 174 A

(21) Application No 8230752  
 (22) Date of filing 28 Oct 1982  
 (30) Priority data  
 (31) 56/172085  
 (32) 29 Oct 1981  
 (33) Japan (JP)  
 (43) Application published  
 15 Jun 1983  
 (51) INT CL<sup>3</sup>  
 B60K 13/02  
 (52) Domestic classification  
 B7H A34  
 (56) Documents cited  
 None  
 (58) Field of search  
 B7H  
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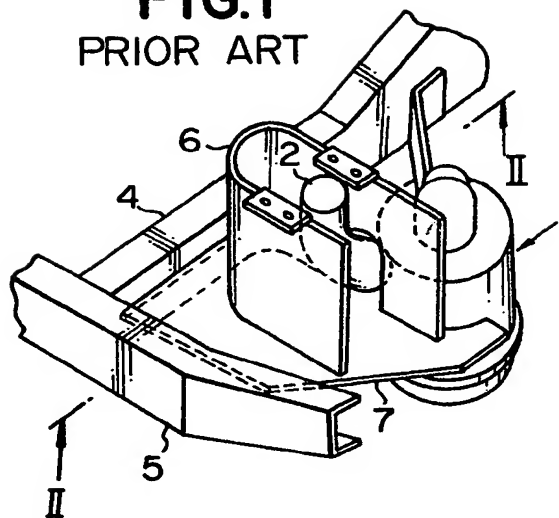
(54) Water-proof structure for air cleaner of automotive internal combustion engine

(57) A water-proof structure for an air cleaner (8) having an air suction duct (9) and mounted on the body structure of an automotive vehicle, wherein a downwardly closed space (20) is formed by members integral with or secured to the body structure of the vehicle and a splash guard plate (19) secured to such members and located at the bottom of the space (20), the air suction duct (9) of the air cleaner (8) extending and opening upwardly into such a space (20) and communicating with the open air through a gap (15) formed by at least one of the above mentioned members.



GB 2 110 174 A

**FIG.1**  
PRIOR ART



**FIG.2**  
PRIOR ART

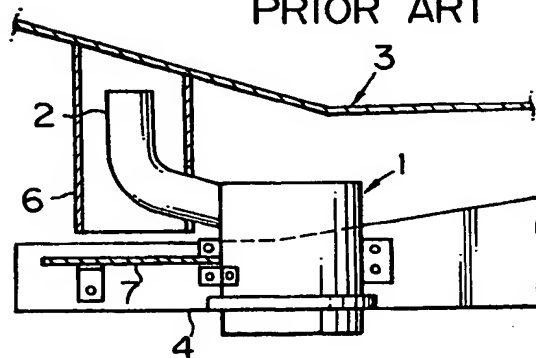


FIG. 3

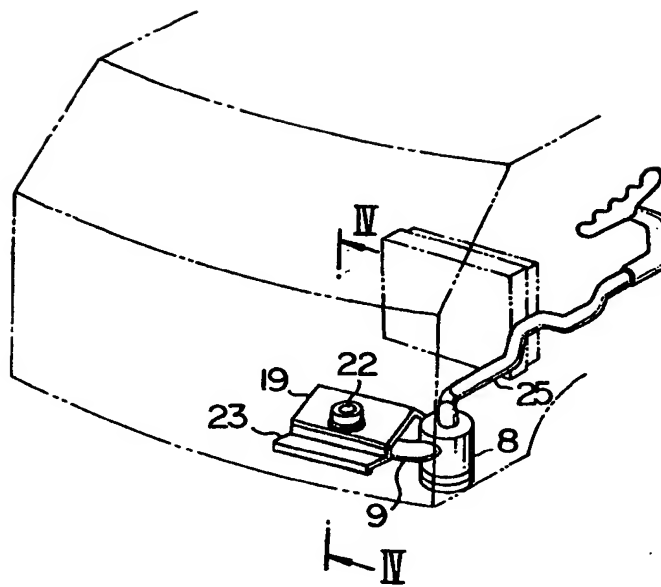


FIG. 4

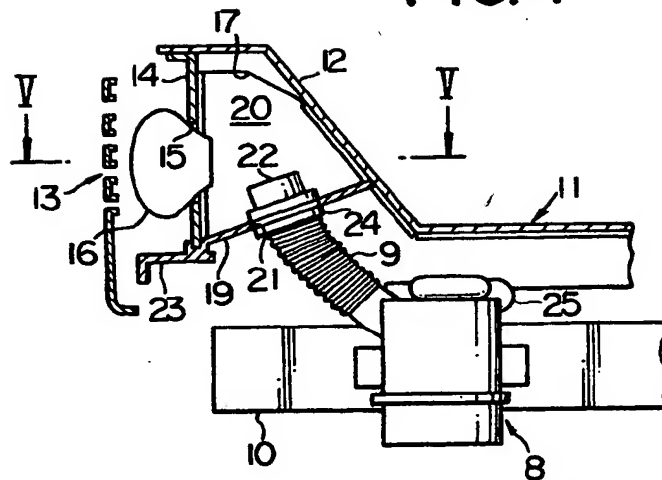
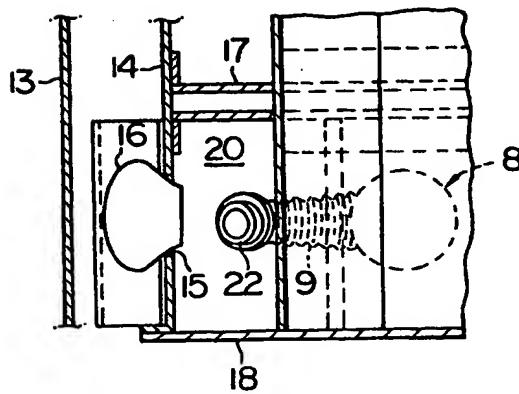


FIG. 5



## SPECIFICATION

### Water-proof structure for air cleaner of automotive internal combustion engine

5

The present invention relates to a water-proof structure for an air cleaner of an internal combustion engine installed on an automotive vehicle.

10 An air cleaner of an automotive internal combustion engine installed on an automotive vehicle has an air suction duct which is ordinarily located vertically between a front portion of the vehicle body and the front road wheels. Such location of the air suction duct of an air cleaner is advantageous to  
15 enable the air cleaner to suck in relatively cold atmospheric air from ahead of the vehicle and to charge the engine with air efficiently.

An air cleaner thus arranged on the body structure of an automotive vehicle is usually provided with a  
20 water-proof structure adapted to protect the air suction duct of the air cleaner from splashes from the front road wheels and to prevent entry of water into the air cleaner when, for example, the vehicle is running on a rain-wet or muddy road or land surface.

25 A prior-art water-proof structure has however not been fully acceptable to accomplish such a purpose as will be discussed in detail. An object of the present invention is to provide an improved water-proof structure capable of satisfactorily protecting  
30 the air suction duct of an air cleaner from splashes from the front road wheels so as to prevent an ingress of water into the air cleaner during operation of the internal combustion engine.

In accordance with the present invention, there is  
35 provided a water-proof structure for an air cleaner having an air suction duct and mounted on the body structure of an automotive vehicle, comprising a horizontal panel member having a raised front end portion, a front vertical member positioned in front  
40 of the panel member, first and second longitudinal members extending rearwardly from the front vertical member and spaced apart from each other laterally of the vehicle body, a first splash guard plate positioned below the raised front end portion  
45 of the horizontal panel member and securely connected along its front end to the front vertical member and along its rear end to the raised front end portion of the panel member for forming a downwardly closed space defined vertically of the  
50 vehicle body between the raised front end portion of the panel member and the splash guard plate, longitudinally of the vehicle body between the raised front end portion of the panel member and the front vertical member and laterally of the vehicle  
55 body between the first and second longitudinal members, the splash guard plate being formed with an opening through which the air suction duct of the air cleaner extends and opens into the above mentioned space, means providing communication  
60 between the space and the atmosphere, and a second splash guard plate projecting forwardly from the front vertical member and positioned below the aforesaid means. The air suction duct of the air cleaner protected by the water-proof structure thus  
65 constructed and arranged is preferably open up-

wardly into the aforesaid space through the opening in the first splash guard plate. If desired, the second splash guard plate may be dispensed with.

The drawbacks of a prior-art water-proof structure  
70 for an air cleaner and the features and advantages of a water-proof structure according to the present invention will be more clearly understood from the following description taken in conjunction with the accompanying drawings in which:

75 Fig. 1 is a fragmentary perspective view showing an example of a prior-art water-proof structure for an air cleaner of an internal combustion engine installed on an automotive vehicle;

Fig. 2 is a sectional view taken on a vertical plane  
80 indicated by line II-II in Fig. 1;

Fig. 3 is a schematic perspective view showing part of a water-proof structure embodying the present invention;

Fig. 4 is a sectional view taken on a vertical plane  
85 indicated by line IV-IV in Fig. 3; and

Fig. 5 is a sectional view taken on a horizontal plane indicated by line V-V in Fig. 4.

Referring to Figs. 1 and 2 of the drawings, an air  
cleaner 1 serving as an air intake unit of an  
90 automotive internal combustion engine has an air intake duct 2 and is fixedly positioned below a front floor panel 3 and in conjunction with a frame 4 and a cross member 5 which form part of the body structure of an automotive vehicle. A prior-art  
95 water-proof structure for such an air cleaner 1 comprises a first or vertical splash guard panel 6 and a second or horizontal splash guard panel 7. The vertical splash guard panel 6 is positioned in front of the air cleaner 1 and is fixedly secured to the  
100 underside of the front floor panel 3 as will be better seen from Fig. 2. The horizontal splash guard panel 7 is positioned below the vertical splash guard panel 6 and is fixedly secured to the frame 4. The vertical splash guard panel 6 has a U-shaped horizontal  
105 cross section and is formed with a slot through which the air intake duct 2 of the air cleaner 1 extends upwardly into the spaced parallel wall portions of the vertical splash guard panel 6. The air intake duct 2 of the air cleaner 1 is thus guarded  
110 horizontally by the vertical splash guard panel 6 and from below by the horizontal splash guard panel 7 and is protected from splashes from the front road wheels (not shown) when the vehicle is running on a rain-wet or muddy road or land surface.

The air intake duct 2 of the air cleaner 1 thus  
115 arranged is open to a vent (not shown) formed in a structural member of the vehicle body and sucks in atmospheric air through this vent. The vent in an automotive vehicle having a water-proof structure of the above described nature is located below the  
120 front floor panel 3. For this reason and further because of the fact that the air intake duct 2 of the air cleaner 1 has an air inlet end located at a relatively low level, water is allowed into the air cleaner 1  
125 when, for example, the vehicle is running on a submerged road and the surface of the water ahead of the front road wheels is forced forwardly of the vehicle and is as a consequence raised over the road surface by the road wheels. Water may also be  
130 admitted into the air cleaner 1 by the splashes from

the front road wheels. A prior-art water-proof structure is thus not fully acceptable to prevent an ingress of water into an air cleaner.

Referring to Figs. 3, 4 and 5 of the drawings, an air cleaner 8 protected by a water-proof structure embodying the present invention is shown having an air suction duct 9 and securely mounted on a suitable longitudinal structural member 10 of the body structure of an automotive vehicle. The vehicle body includes a horizontal panel member constituted by a floor panel 11 having a raised front end portion 12 at the rear of a front radiator grille structure 13. In front of the floor panel 11 and at the rear of the radiator grille structure 13 is provided a front vertical member constituted by a front bolster 14 formed with an opening 15 through which a head lamp 16 directed forwardly of the vehicle body are fitted to the front bolster 14. The floor panel 11 is integral with or securely connected to first and second longitudinal members which are respectively constituted, in the embodiment herein shown, by a longitudinal floor member 17 and an inner component member 18 of a step-sill structure having a step member (not shown) mounted thereon. The floor member 17 and the inner component member 18 of the step-sill structure longitudinally extend rearwardly from the front bolster 14 below the floor panel 11 and are spaced apart from each other laterally or transversely of the vehicle body.

A first splash guard plate 19 is positioned below the raised front end portion 12 of the floor panel 11 and is securely connected along its front end to the front bolster 14 and along its rear end to the raised front end portion 12 as will be best seen from Fig. 4.

A space 20 having a closed lower end is accordingly defined vertically of the vehicle body between the first splash guard plate 19 and the raised front end portion 12 of the floor panel 11, longitudinally of the vehicle body between the front bolster 14 and the raised front end portion 12 of the floor panel 11 and laterally of the vehicle body between the floor member 17 and the inner component member 18 of the step-sill structure. The first splash guard plate 19 is formed with an opening 21 through which the air suction duct 9 of the air cleaner 8 extends and opens upwardly as at 22 into the space 20. The opening 15 formed in the front bolster 14 is sized in such a manner as to form a gap between the front bolster 14 and the head lamp 16 so that the above mentioned space 20 is allowed to be open to the atmosphere through this gap and the slots formed in the front radiator grille structure 13. Below the head lamp 16 is positioned a second splash guard plate 23 which is securely connected to the front bolster 14 and which project forwardly from the lower end of the front bolster 14 as will be best seen from Fig. 4. The second splash guard plate 23 is adapted to protect the air suction duct 9 of the air cleaner 8 from splashes from the front road wheels (not shown).

The air suction duct 9 of the air cleaner 8 is fitted to the first splash guard plate 19 preferably by means of an elastic member 24 adapted to absorb vibrations of the air suction duct 9. The air cleaner 8 communicates with the air intake unit of an internal combustion engine through an air feed hose 25 as

will be best seen from Fig. 3.

When the engine is in operation, atmospheric air passed through the slots in the front radiator grille structure 16 is admitted into the space 20 through the gap formed between the front bolster 14 and the head lamp 16 and is sucked into the air suction duct 9 of the air cleaner 8. If the vehicle is running on a rain-wet or muddy road or land surface, the splashes from the front road wheels are caused to impinge partially upon the lower surface of the first splash guard plate 19 and partially upon the lower surface of the second splash guard plate 23. The splashes caused to impinge upon the lower surface of the first splash guard plate 19 are thus precluded from being admitted into the space 20. The splashes caused to impinge upon the lower surface of the second splash guard plate 23 are precluded from reaching the gap between the front bolster 14 and the head lamp 16. Because, furthermore, of the fact that the air suction duct 9 of the air cleaner 8 has its upwardly open end 22 located at a relatively high level, an ingress of water into the air suction duct 9 of the air cleaner 8 can be prevented even when the vehicle is running on a submerged road.

While the gap providing communication between the space 20 and the open air is formed in portions of the front bolster 14 in the hereinbefore described embodiment, such a gap may be formed between the raised front end portion 12 of the floor panel 11 and the upper end of the front bolster 14 or may be substituted by an opening formed in a suitable member additionally attached to the vehicle body, though not shown in the drawings. It will be also apparent that the space 20 into which the air suction duct 9 of the air cleaner 8 is open has been described to be formed by the front bolster 14, the longitudinal floor member 17 and the inner component member 18 of the step-sill structure but may be defined by any other structural members of the vehicle body.

#### CLAIMS

1. A water-proof structure for an air cleaner having an air suction duct comprising
  - a horizontal panel member having a raised front end portion,
  - a front vertical member positioned in front of the panel member,
  - first and second longitudinal members extending rearwardly from said front vertical member and spaced apart from each other laterally of the vehicle body,
  - a splash guard plate positioned below the raised front end portion of said horizontal panel member and securely connected along its front end to said front vertical member and along its rear end to said raised front end portion for forming a downwardly closed space defined vertically of the vehicle body between said raised front end portion and said splash guard plate, longitudinally of the vehicle body between said raised front end portion and said front vertical member and laterally of the vehicle body between said first and second longitudinal members, said splash guard plate being formed with an opening through which the air suction duct of said air cleaner extends and opens into said space,

means providing communication between said space and the atmosphere.

2. A water-proof structure for an air cleaner having an air suction duct comprising

5 a horizontal panel member having a raised front end portion,  
a front vertical member positioned in front of the panel member,

10 first and second longitudinal members extending rearwardly from said front vertical member and spaced apart from each other laterally of the vehicle body,

15 a first splash guard plate positioned below the raised front end portion of said horizontal panel member and securely connected along its front end to said front vertical member and along its rear end to said raised front end portion for forming a downwardly closed space defined vertically of the vehicle body between said raised front end portion  
20 and said splash guard plate, longitudinally of the vehicle body between said raised front end portion and said front vertical member and laterally of the vehicle body between said first and second longitudinal members, said splash guard plate being  
25 formed with an opening through which the air suction duct of said air cleaner extends and opens into said space,

means providing communication between said space and the atmosphere, and

30 a second splash guard plate projecting forwardly from said front vertical member and positioned below said means.

3. A water-proof structure as set forth in claim 1 or 2, in which the air suction duct of said air cleaner  
35 is open upwardly into said space through the opening in said first splash guard plate.

4. A water-proof structure as set forth in claim 1 or 2, in which said horizontal panel member and said vertical member are respectively constituted by a  
40 floor panel and a front bolster of the vehicle body.

5. A water-proof structure as set forth in claim 1 or 2, in which said first and second longitudinal members are respectively constituted by a longitudinal floor member and an inner component member of a step-sill structure.  
45

6. A water-proof structure as set forth in claim 1 or 2, in which said horizontal panel member and said vertical member are respectively constituted by a floor panel and a front bolster of the vehicle body  
50 and in which said first and second longitudinal members are respectively constituted by a longitudinal floor member and an inner component member of a step-sill structure.

7. A water-proof structure as set forth in claim 1  
55 or 2, in which said means comprises a portion of said front vertical member, said portion of the front vertical member being formed with an opening through which a head lamp is fitted to the front vertical member, said opening in the front vertical  
60 member being sized to form between the front vertical member and the head lamp a gap which is open to said space.

8. A water-proof structure as set forth in claim 1 or 2, in which said means comprises a portion of  
65 said horizontal panel member and a portion of said

front vertical member, the portions of the horizontal panel member and the front vertical member forming therebetween a gap which is open to said space.

9. A water-proof structure as set forth in claim 1  
70 or 2, in which said means comprises a member secured to the vehicle body and formed with a gap which is open to said space.

10. A water-proof structure as set forth in claim 1,  
75 further comprising an elastic member fitted between said splash guard plate and the air suction duct of said air cleaner and adapted to absorb vibrations of the air suction duct.

11. A water-proof structure as set forth in claim 2,  
80 further comprising an elastic member fitted between said first splash guard plate and the air suction duct of said air cleaner and adapted to absorb vibrations of the air suction duct.

12. A water-proof structure for an air cleaner substantially as described with reference to, and as  
85 illustrated in Figs. 3 to 5 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.,  
Berwick-upon-Tweed, 1983.  
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY,  
from which copies may be obtained.